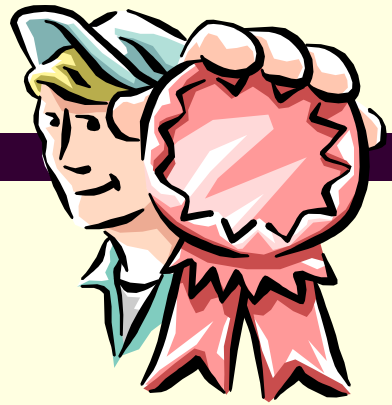
Advanced Production and Quality Management Course

Quality Function Deployment (QFD)

CDR Ric Schulz



What's in a Name?

HIN SHITSU ***KI NO*** ***TEN KAI***

Quality **Function** **Deployment**

Attributes **Development**

Features **Evolution**

"Customer Driven Product/Process Development"
"The House of Quality"
"The Voice of the Customer"

Purpose of QFD

- **1. Prioritize spoken and unspoken customer wows, wants, and needs.**
- **2. Translate these needs into technical characteristics and specifications.**
- **3. Build and deliver a quality product or service by focusing everybody toward customer satisfaction.**

Origins of QFD

- Introduced in 1966 by Yoji Akao
- First structured use attributed to the Kobe Shipyard of Mitsubishi Heavy Industries, Ltd in 1972
- Introduced to US in 1983 article in Quality Press, an ASQC publication
- Leaders in applying QFD in Japan include; Akao, Macabe and Fukahara

QFD in North America

- Recently been introduced in North America
  - Ford uses it in transmission assembly plant
  - Proctor and Gamble developed Luvs Disposable Diapers and the Crest Complete Toothbrush
  - Chrysler developed vehicles such as the NEON
- In 1984 companies began considering QFD for software [illegible]ment

hat is Quality Function Deployment?

FD is a bad name for a great tool!!!!!

FD is a lot of common sense wrapped up in a very structured process.

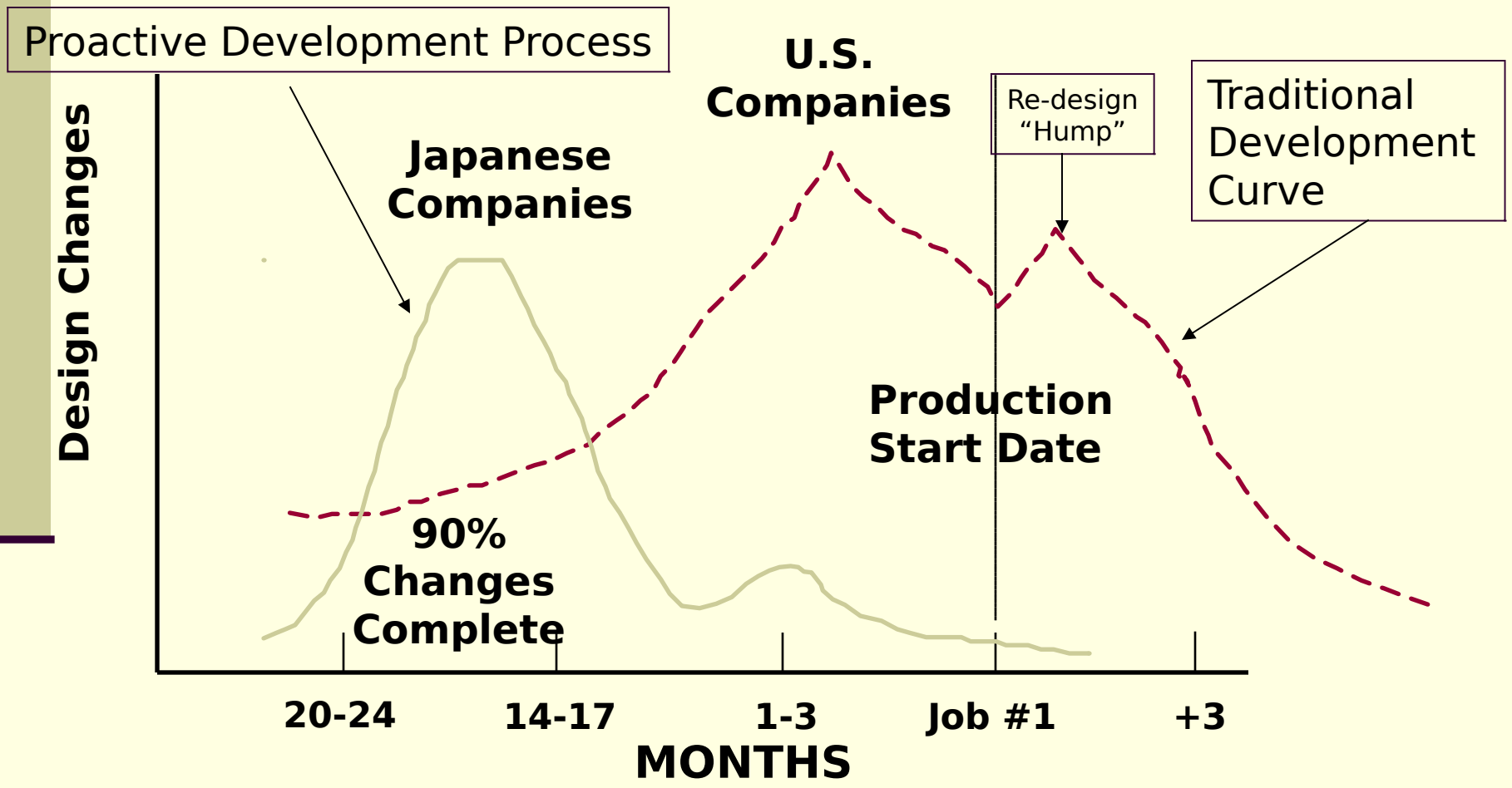
FD keeps the Customer Focus.

FD is efficient – it uses the 80/20 approach (80% benefit w/ 20% effort).

FD improves the Integrated Product and Process Development (IPPD) sy

- Ultimate benefit of QFD is a timely delivery of a product or ser
that meets or exceeds the customers expectations

QFD Results



: Area under curves represent the Cost of Developing/Deploying a Prod

Top 10 Reasons When QFD is Appropriate……

1. **Customers** are complaining or are **not satisfied** with your product, service or software.
2. Extended development time due to **excessive redesign, problem solving or firefighting**.
3. **Poor communications** exist between departments or functions in designing/developing a product.
4. Lack of structure of logic for your company's **allocation of resources**.
5. When there is poor **documentation of** the rationale and logic behind **key product design** or process decisions.
6. When the **competition is fierce**, the potential market and profits are great, and there is little time for mistakes.
7. Your attitude is: "If it ain't broke, don't fix it".
8. When you are truly serious about better **understanding your customer and competitive position**.
9. **Market share** has been consistently **declining**.

Potential Benefits

- **Systematic documentation of engineering knowledge, which be more easily applied to future designs**
- **Easier identification of specific competitive advantages**
- **More competitive pricing of products or services, due to lower development and start-up costs**

Phases of QFD

Classic 4 Phases:

- Product Planning
- Design Deployment
- Process Planning
- Production Control

Extended QFD:

- Planning the Project
- Documenting & Prioritizing Requireemnts
- Developing Metrics
- Design Deployment
- Process Planning
- Production Control

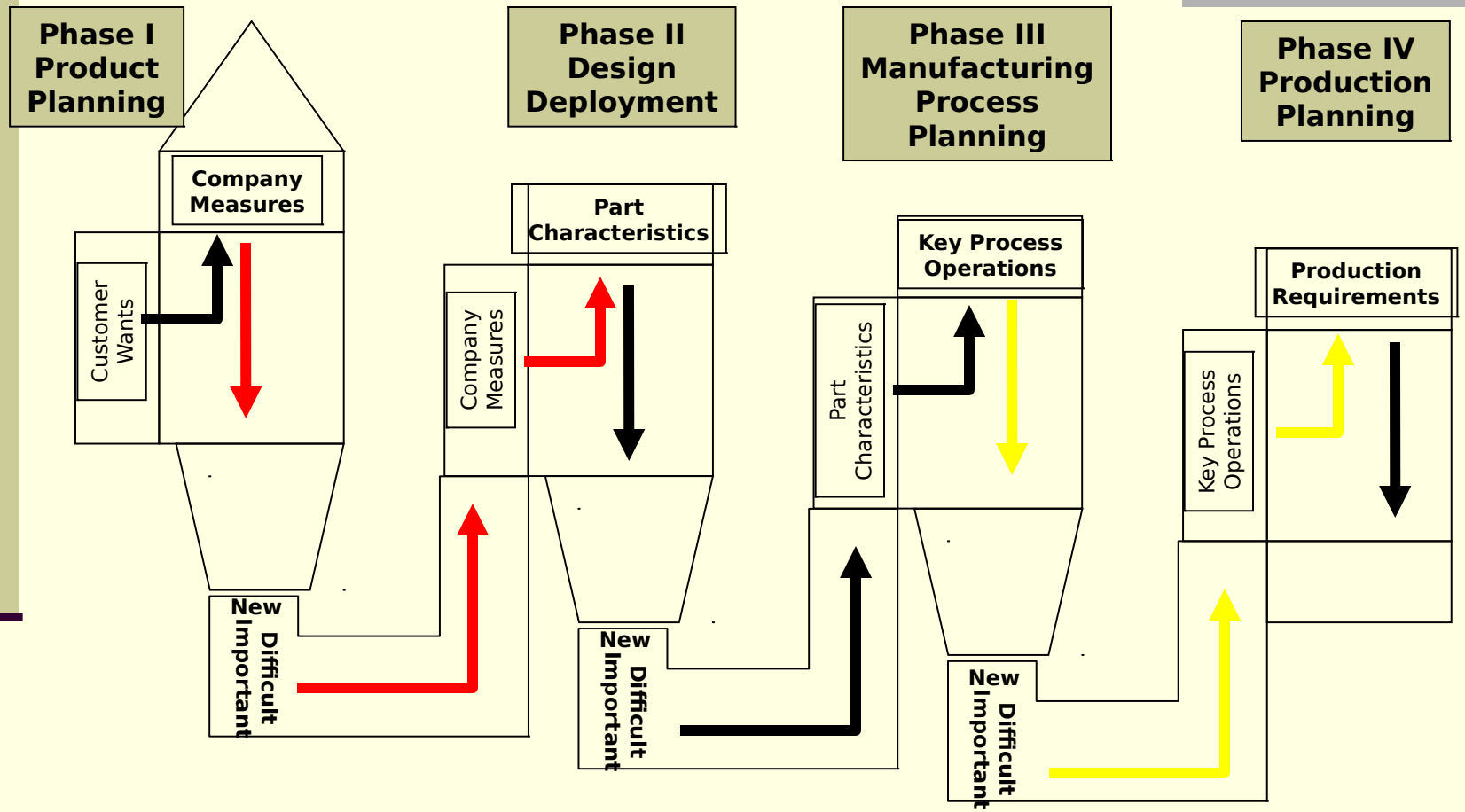
Strategies for Developing “Needs”

Basic Needs:
- Your experience
- Customer complaints
- Industry standards
- Observe competition
- Perform Functional Analysis (SEP)

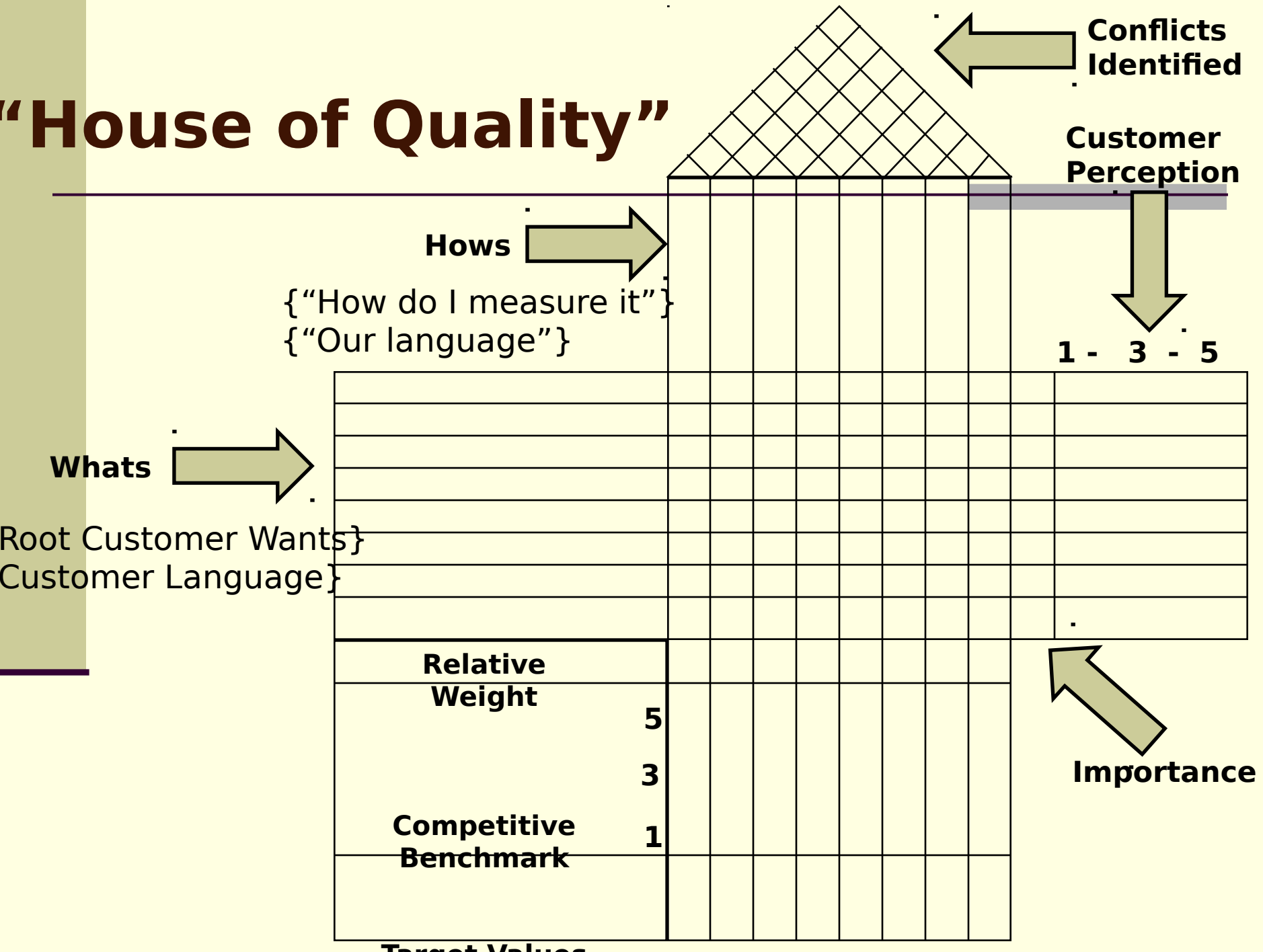
Performance Needs:
- Classic Market Research
- Focus Groups
- Surveys/clinics
- Statements of Work/Req’ts
- Customer Inventories
- Existing company information
- Contextual inquiry (interview)

Excitement Needs:
- Classic Brainstorming
- Lateral Benchmarking
- Scope Expansion
- Innovation
- Right people
- Technology Forecast
- Trend Analysis
- Technology Optimizer Software

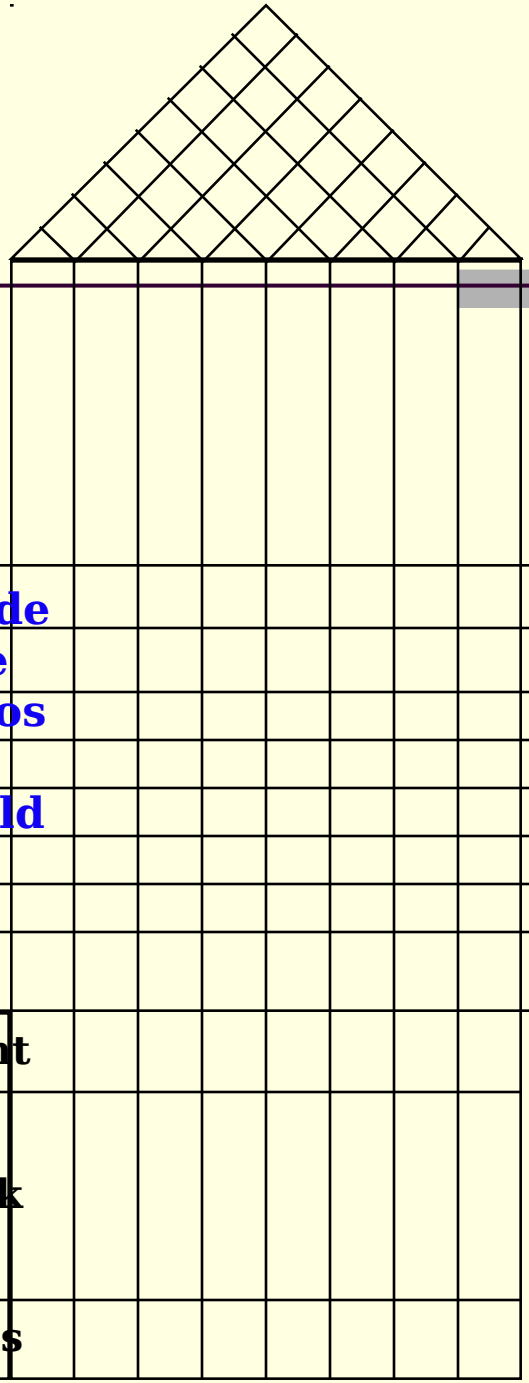
QFD Process -- The 50,000 Foot View



“House of Quality”



Whats

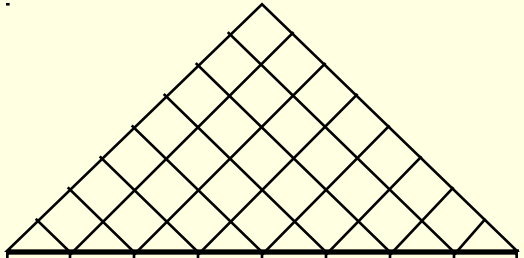

1 - 3 - 5
Window Operates Easily
Easy To Open And Close
Lock/ Unlock Easily
Easy Close From Outside
Easy Open From Inside
Stays Open in Check Pos
Crank Easy to Reach
Crank Easy to Grasp/Hld
Operates Rapidly
Key Operates Easily
Doesn't Freeze
Relative Weight
Competitive Benchmark
Target Values

Whats

Making a Good “What”

- Root wants, not design solutions
- Objectives, customer requirements
- Technical and regulatory requirements
- Organize, consolidate, and translate the customer needs

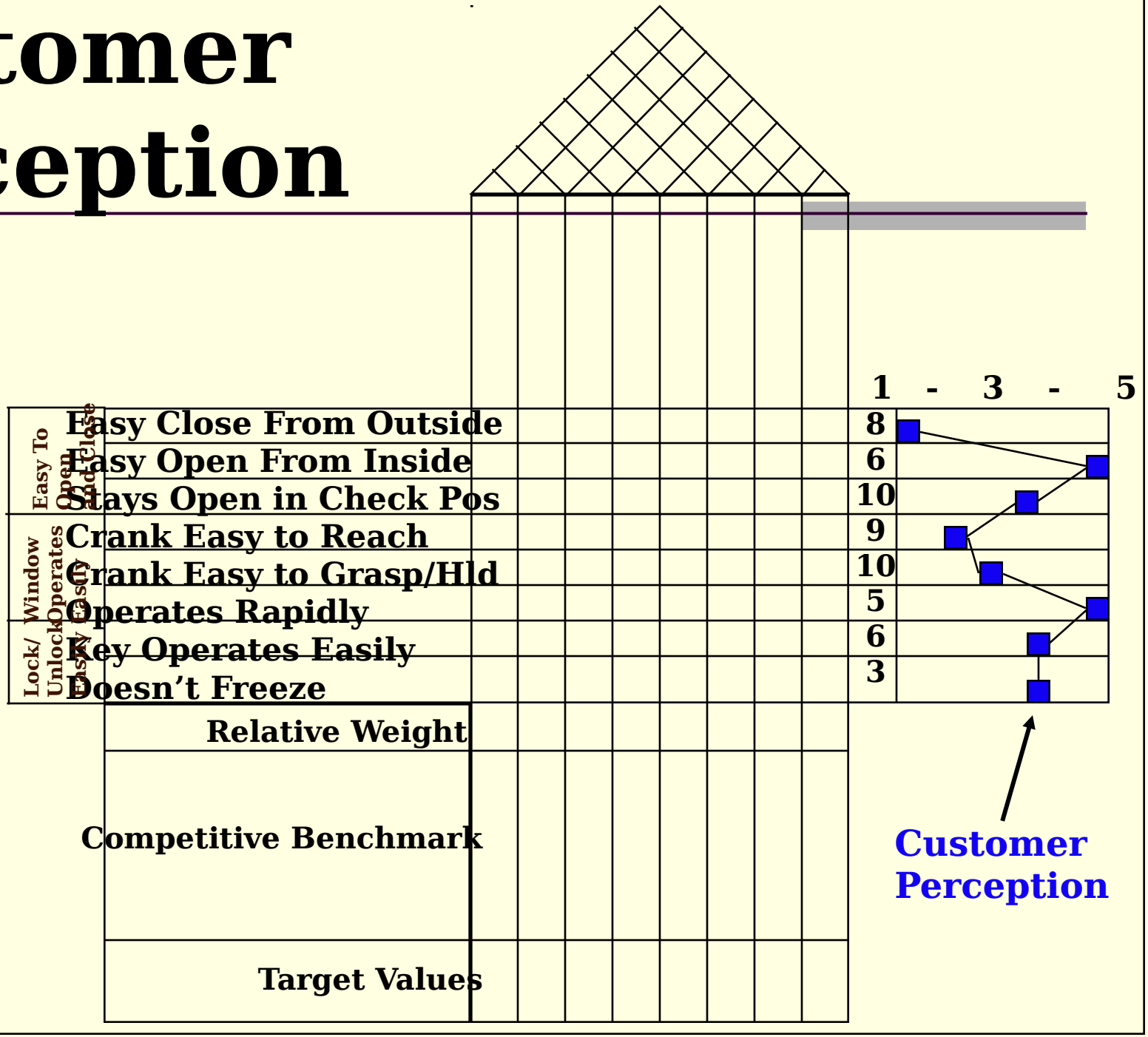
Importance



		1 - 3 - 5
Window Operates Easily	Easy To Open and Close	
	Easy Close From Outside	8
	Easy Open From Inside	6
	Stays Open in Check Pos	10
	Crank Easy to Reach	9
	Crank Easy to Grasp/Hld	10
	Operates Rapidly	5
Lock/ Unlock Ability	Key Operates Easily	6
	Doesn't Freeze	3
	Relative Weight	
	Competitive Benchmark	
	Target Values	

Importance

Customer Perception



Hows

		Dr Cls Effort	D/S Opn Effort	P/S Opn Frc	Seat Hld Opn Frc	Reach Distance	Grip Frc to Crnk	Cycle Time	Lock/Unlck Time	Freeze	Resistance	1 - 3 - 5
Easy To Open And Close	Easy Close From Outside										8	
	Easy Open From Inside										6	
	Stays Open in Check Pos										10	
Window Operates Easily	Crank Easy to Reach										9	
	Crank Easy to Grasp/Hld										10	
	Operates Rapidly										5	
Lock/ Unlock Easily	Key Operates Easily										6	
	Doesn't Freeze										3	
	Relative Weight											
	Competitive Benchmark											
	Target Values											

What is a “How”?

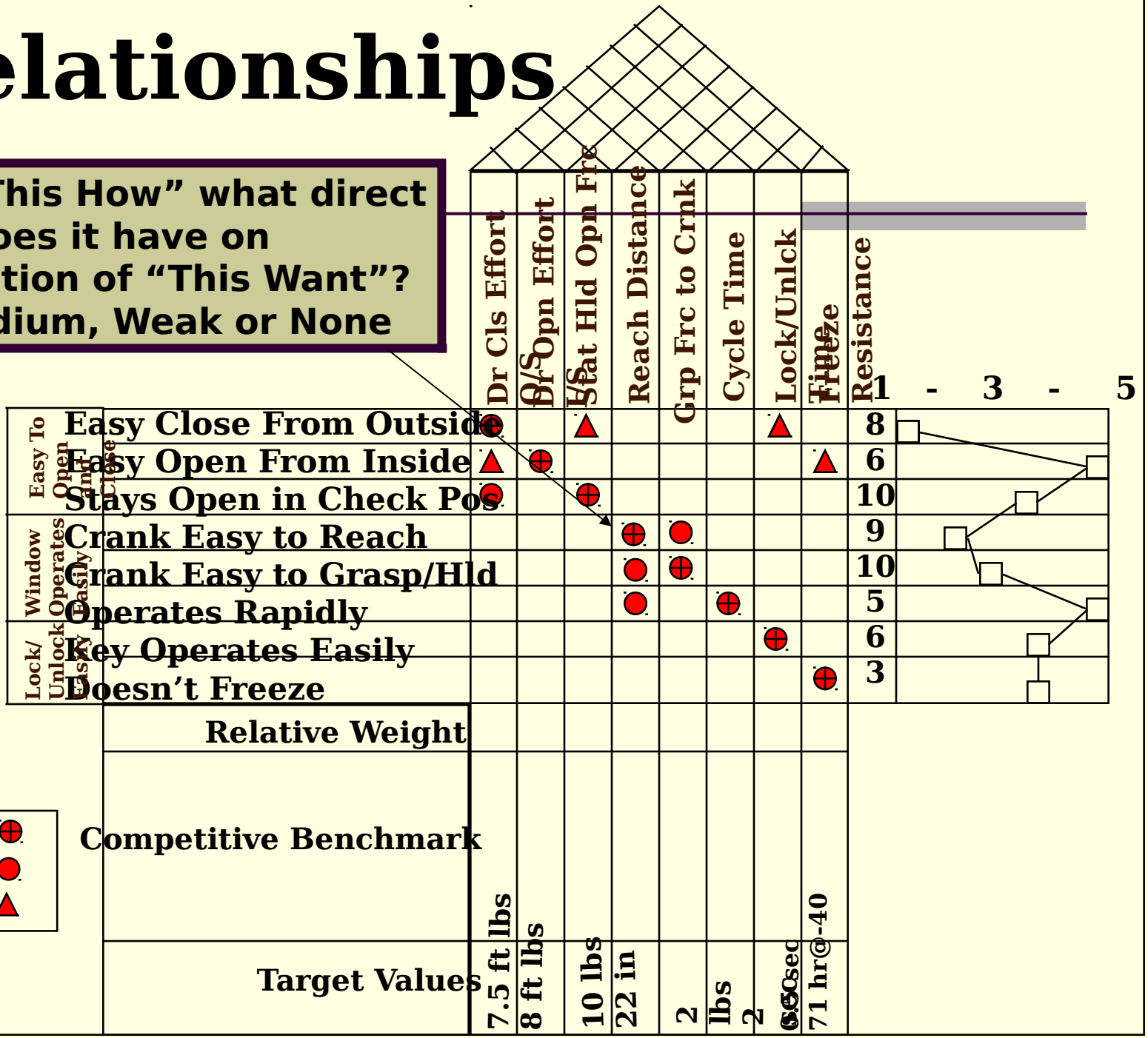
- Internal Company Measure (pro-active measure)
- Objective and Measurable (put units on it)
- Controllable/Proactive (you have control)
  - “Safe braking” versus “No accidents”
- No design constraints/solutions (no paradigms)
  - “Energy absorbed” versus “airbag”
- Representative and appropriate (represents the product)
  - “0 to 60 time” versus “horsepower”

How Much

		Dr Cls Effort	Dr Opn Effort	Seat Hld Opn Frc	Reach Distance	Grp Frc to Crnk	Cycle Time	Lock/Unlck Time	Freeze Resistance	1 - 3 - 5
Easy To Open And Close	Easy Close From Outside								8	
	Easy Open From Inside								6	
	Stays Open in Check Pos								10	
Window Operates Easily	Crank Easy to Reach								9	
	Crank Easy to Grasp/Hld								10	
	Operates Rapidly								5	
Lock/ Unlock Easily	Key Operates Easily								6	
	Doesn't Freeze								3	
	Relative Weight									
	Competitive Benchmark									
	Target Values	7.5 ft lbs	8 ft lbs	10 lbs	22 in	2	lbs 2	sec 5	71 hr@-40	

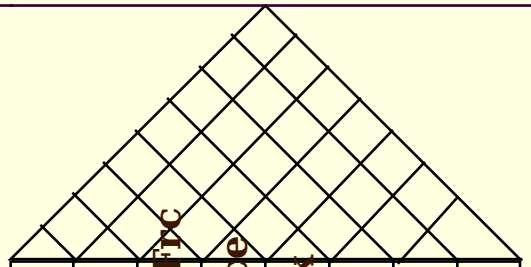
nterrelationships

"If I vary "This How" what direct influence does it have on the satisfaction of "This Want"? Strong, Medium, Weak or None



Relative Weight

STRONG ⊕ **9**
MEDIUM ○ **3**
WEAK △ **1**



		Dr Cls Effort	Dr O/S Opn Effort	Lat Hld Opn Frc	Reach Distance	Grp Frc to Crnk	Cycle Time	Lock/Unlck Time	Freeze Resistance	1 - 3 - 5
Easy To Open And Close	Easy Close From Outside	⊕		△				△	8	
	Easy Open From Inside	△	⊕					△	6	
	Stays Open in Check Pos	○		⊕					10	
Window Operates Easily	Crank Easy to Reach				⊕	○			9	
	Crank Easy to Grasp/Hld				○	⊕			10	
	Operates Rapidly				○		⊕		5	
Lock/ Unlock Easily	Key Operates Easily							⊕	6	
	Doesn't Freeze							⊕	3	
	Relative Weight	10	54	9	8 12	6 11	7 45	62	33	
	Competitive Benchmark	5								
		1								
	Target Values	7.5 ft lbs	8 ft lbs	10 lbs	22 in	2	lbs 2	0.5 sec	71 hr@-40	

9X8=72
1X6=6
3X10=30
Total=108

Competitive Benchmarking

STRONG ⊕
MEDIUM ○
WEAK △

		Dr Cls Effort	Dr Opn Effort	Seat Hld Opn Frc	Reach Distance	Grp Frc to Crnk	Cycle Time	Lock/Unlck Time	Freeze	Resistance	1 - 3 - 5
Easy To Open And Close	Easy Close From Outside	⊕		△				△		8	
	Easy Open From Inside	△	⊕						△	6	
	Stays Open in Check Pos	○		⊕						10	
Window Operates Easily	Crank Easy to Reach				⊕	○				9	
	Crank Easy to Grasp/Hld				○	⊕				10	
	Operates Rapidly				○		⊕			5	
Lock/ Unlock Easily	Key Operates Easily							⊕		6	
	Doesn't Freeze								⊕	3	
	Relative Weight	10	8 54	9	8 12	6 11	7 45	62	33		
	Competitive Benchmark										
	Target Values	7.5 ft lbs	8 ft lbs	10 lbs	22 in	2	lbs 2	sec 0.5	71 hr@-40		

5
1

Roof (Correlation Matrix)
Hows vs. Hows

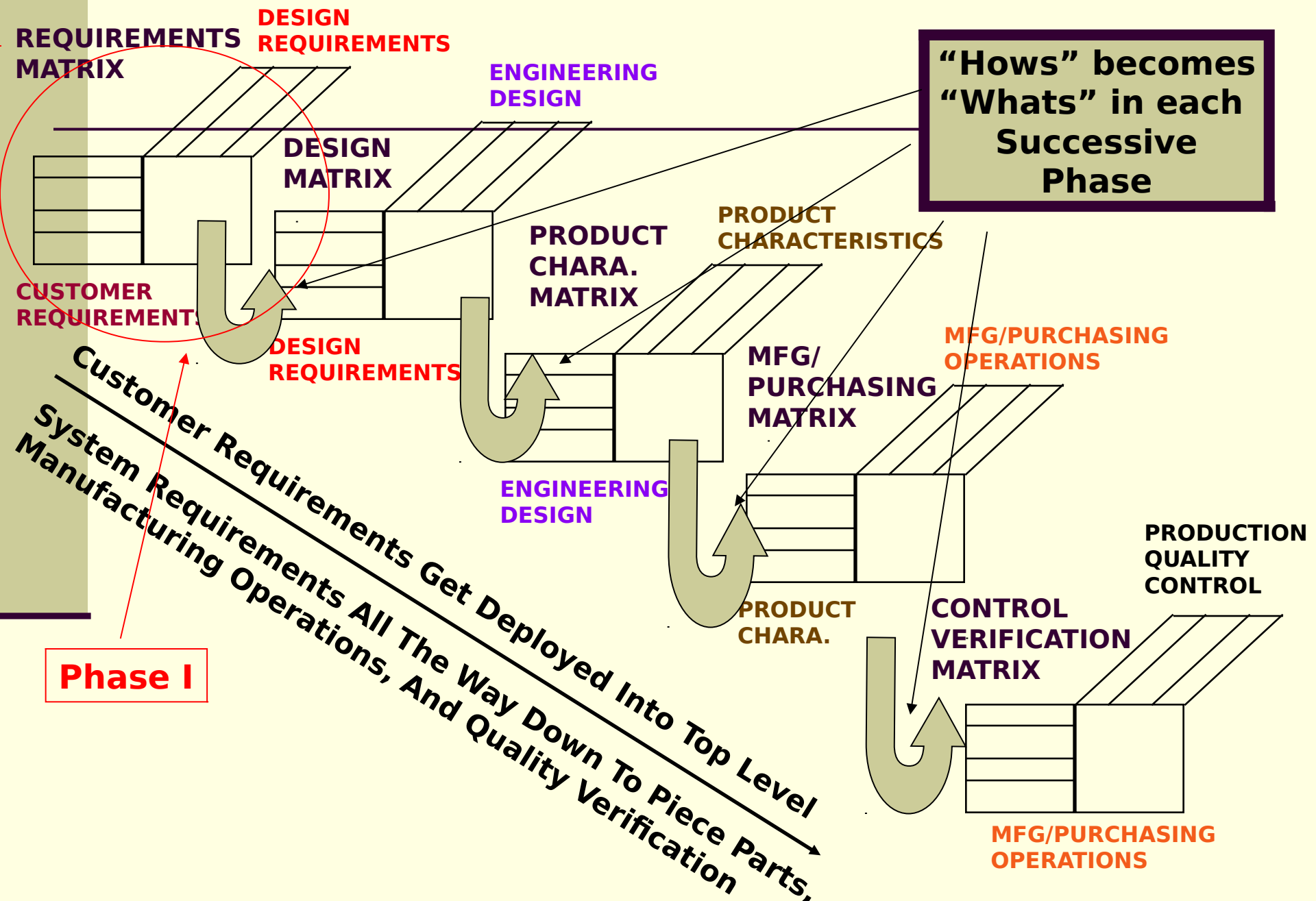
TECHNICAL INTERACTIONS

Ask; “If I do X will I hurt or help Y?”

Positive/Strong Positive O
NEGATIVE X
STRONG #
NEGATIVE

		Dr Cls Effort	Dr Opn Effort	Stat Hld Opn Frc	Reach Distance	Grp Frc to Crnk	Cycle Time	Lock/Unlck Time	Freeze Resistance	1 - 3 - 5
Easy To Open and Close	Easy Close From Outside	⊕		△				△		8
	Easy Open From Inside	△	⊕						△	6
	Stays Open in Check Pos	○		⊕						10
Window Operates Easily	Crank Easy to Reach				⊕	○				9
	Crank Easy to Grasp/Hld				○	⊕				10
	Operates Rapidly				○		⊕			5
Lock/ Unlock Easily	Key Operates Easily							⊕		6
	Doesn’t Freeze								⊕	3
	Relative Weight	10	8 54	9	8 12	6 11	7 45	62	33	
	Competitive Benchmark	5 / 1								
	Target Values	7.5 ft lbs	8 ft lbs	10 lbs	22 in	2	lbs	2	71 hr@-40	

Transformation Methodology



Transformation Methodology

rom Customer Requirement to Material & Manufacturing Process Selection to Include Testing & Quality Assurance Verification

Customer Requirement
Support the SIOP
- Be on Time
(a Key Requirement)

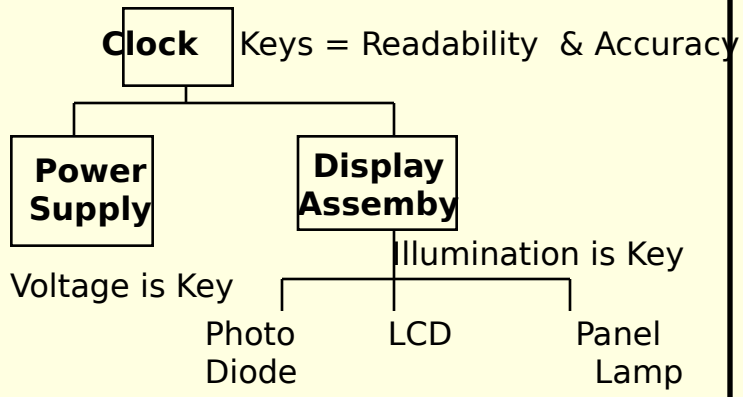
Phase I

Phase II

Phase III

Phase IV

Subsystem Requirement



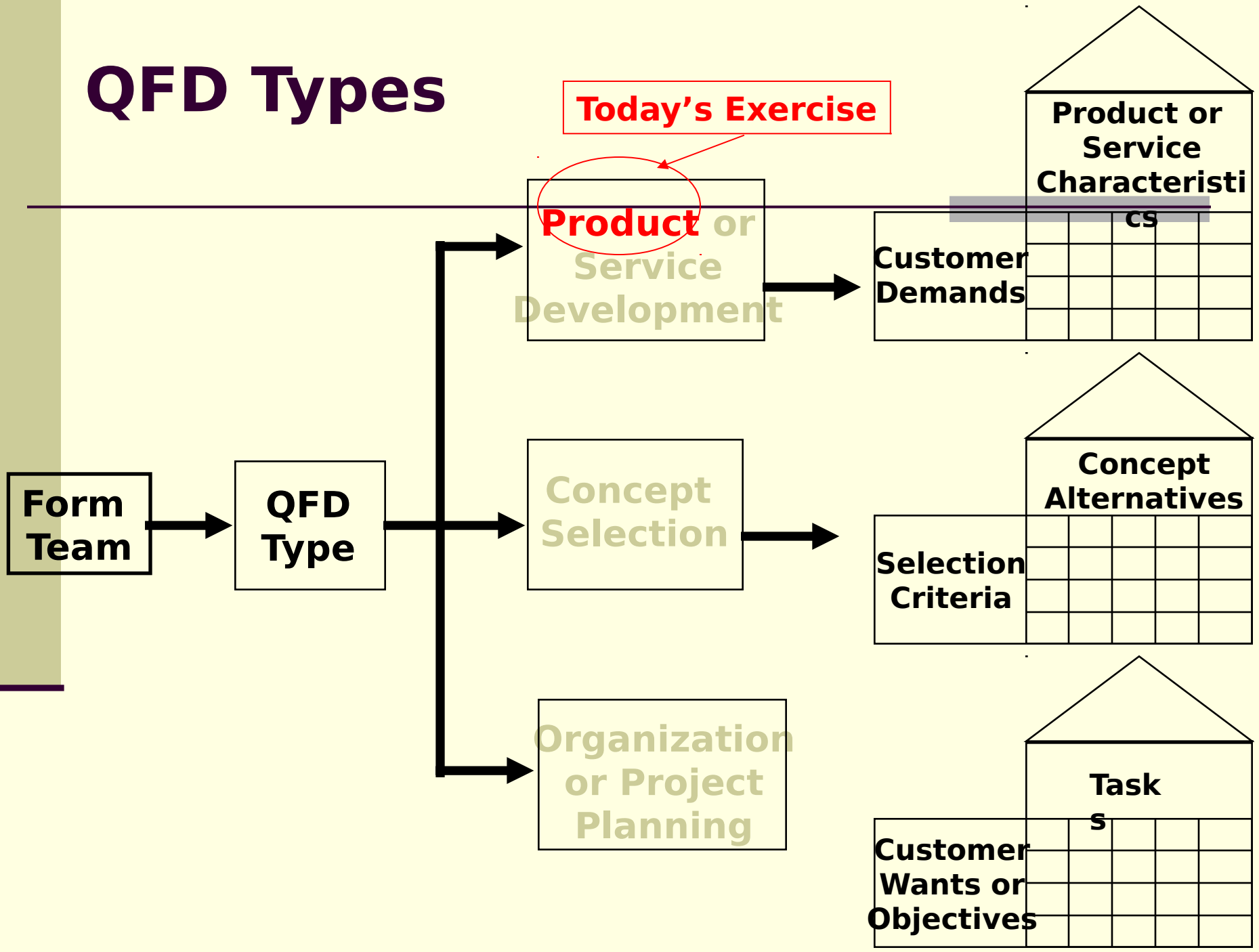
Manufacturing Requirements (Keys)

- **Hardware Requirements**
  - MIL-SPEC Diode in Power Supply
  - Good solder joints
- **Process Requirements**
  - MIL-STD-2000 Requirement
  - Use Wave Solder Machine
- **Quality Verification Requirements**
  - Use DOE to Identify Key Manufacturing Process Factors
  - Use SPC to Control Process & Document Variation on Key Process Factors

QFD Applications

- Best applied to specific needs
- Areas that need significant improvements or “breakthrough” achievements
- Can be used for any type of product or service
  - discrete manufacturing
  - continuous and batch processes
  - software development
  - construction projects
  - customer service activities

QFD Types


Today's Exercise
Product or Service Characteristics
Product or Service Development
Customer Demands
Form Team
QFD Type
Concept Selection
Concept Alternatives
Selection Criteria
Organization or Project Planning
Tasks
Customer Wants or Objectives

Voice of the Customer

- **Defining the “voice” is the most time consuming step in QFD**
- **Use requirements engineering techniques.**
- **Have the customer define quality using their own terms.**

Some requirements are NOT easy to identify.